

**American Academy of Spinal Cord Injury Professionals
ASCIP 2017 Educational Conference and Expo
Rocky Mountain High
Expectations for SCI**

Sunday, September 3, 2017 - Wednesday, September 6, 2017
Colorado Convention Center/Hyatt Regency Denver
700 14th Street & 650 15th Street
Denver, Colorado
USA

Presentation abstracts 1 – 37

1 Adaptation of a group diabetes prevention program for individuals with spinal cord injury

Katherine Stenson^{1,2}, Flora Hammond¹, Connie Fiems³

¹Indiana University School of Medicine, Indianapolis, IN, USA; ²Washington University School of Medicine, St. Louis, MO, USA; ³University of Indianapolis, Indianapolis, IN, USA

Objective: To adapt a successful group wellness program for individuals with SCI. There is an increased risk of type 2 diabetes in individuals with wheelchair-reliant spinal cord injury (SCI), especially in those individuals who have a higher body mass index. The Diabetes Prevention Program (DPP) study, which was carried out in the able-bodied population, showed that type 2 diabetes can be prevented or delayed by losing just 7% of body weight through regular physical activity and healthy eating. This was done with one-on-one guidance of a lifestyle coach. The DPP has been modified into a group program, called Group Lifestyle Balance (GLB), and has shown success. The need to adapt such an intervention for individuals with SCI was a main driver of this project.

Design: Freestanding rehabilitation hospital, prospective pilot study with 2 phases: 1.) modify the GLB for individuals with Spinal Cord Injury and perform focus group to identify any perceived barriers; 2.) run a pilot study evaluating the feasibility of the treatment as well as efficacy.

Participants/methods: Adapt the GLB for individuals with wheelchair-reliant SCI with input from physical therapy, nutrition, and the population served. Pilot study including 12 individuals with wheelchair-reliant SCI and measure BMI, anthropomorphic index, blood pressure, hemoglobin A1c, lipids and satisfaction, and knowledge, at baseline, 6 months, and 1 year. Participants were individuals with wheelchair-reliant SCI for over a year with risks for diabetes and BMI 22 or over.

Results: The GLB was modified and carried out for a 12-month course. Data from the pilot study showed that there were improvements in knowledge (by 1.25 points), physical activity readiness (PARQ score increase by 1.25, $P=0.038$), BMI (-1.69 at 6 months, $P=0.04$) and weight circumference (-3.14, $P=0.034$). There was also some improvement in triglycerides at 12 months (-31.25) based on moderate effect size (-0.56), but was not statistically significant.

Conclusion: The GLB was successfully adapted for individuals with wheelchair-reliant SCI and there were improvements in readiness and knowledge of successful lifestyle strategies as well as some anthropomorphic and lipid measures. This kind of a group-based wellness program is feasible and efficacious in decreasing BMI and waist circumference, which is ultimately protective against developing diabetes and cardiovascular disease.

Support: Indiana Spinal Cord and Brain Injury Research Fund.

2 Adverse event profile of high (>600 units) vs lower dose botulinum toxin

Steven Kirshblum^{1,2}, Neil Jasey Jr^{1,2}, Stephen Hampton², Michelle Didesch², Ryan Solinsky², Benjamin Seidel^{1,2}, Darine Androwis

¹Kessler Institution for Rehabilitation, West Orange, NJ, USA; ²Rutgers New Jersey Medical School, Newark, NJ, USA

Objective: Botulinum toxin injections into peripheral limb and neck muscles is effective in relieving focal spasticity resulting from upper motor neuron (UMN) injuries including spinal cord injury (SCI). Approved dosages for onabotulinumtoxinA and incobotulinumtoxinA are up to 400 units, yet often times higher dosages are used to achieve a therapeutic effect. This study was undertaken to determine differences in adverse effects using higher dosages (≥ 600 units) as compared with lower (≤ 400 u) and intermediate dosages (401-599u) of toxin.

Design: Retrospective analysis of injections performed over a 3-year period at a free-standing rehabilitation hospital.

Participants/methods: All patients were included who underwent injection for limb spasticity and also had a follow up where documentation of adverse reactions or lack thereof occurred. Injections were divided into the three dosage ranges as above. Adverse events were divided into major categories including respiratory, unintended weakness, dysphagia, pain or discomfort, etc. and correlated with dosage, sites of injection, and dilution.

Results: 914 injections (in 351 patients) met inclusion criteria including 65% - ≤ 400 u, 21% - 401-599u, and 14% - ≥ 600 u. Overall complications related to the toxin were not significantly different between the groups ($\chi^2 = 0.994$, $P = 0.608$); 2.6% (≤ 400 u), 2.1% (401-599u) and 3.9% (≥ 600 u). The most common adverse effects included unintended weakness [0.69% (≤ 400 u), 0.53% (401-599 u) and 2.36% (≥ 600 u)], followed by pain related to the injection [0.69%, 1.10% and 0% respectively]. Dysphagia occurred in 0.35% or $n=2$ (≤ 400 u), 0% (401-599 u) and 0.79% or $n=1$ (≥ 600 u) of patients. Of patients with dysphagia ($n=3$), one patient had an injection to cervical muscles only (200 u), one to upper & lower extremities (400u) and the other for upper limb only (700u).

Conclusion: Adverse events from high dose (≥ 600 u) of onabotulinumtoxinA and incobotulinumtoxinA were not significantly different from lower or intermediate dosages.

Support: Supported in part by educational funding from Medtronic.

3 Assistive technology education and training for individuals with SCI

Melissa Braucht, Stephanie Kaplan, Emily R. Rosario

Casa Colina Hospital and Centers for Healthcare, Pomona, CA, USA

Purpose: The assistive technology (AT) program, known as the “AT Boot Camp” was developed to provide the tools and support necessary for individuals with a spinal cord injury (SCI) to improve their independence, emotional and physical well-being, and overall quality of life in a timely manner.

Background: Assistive Technology creates an important resource for adapting and learning to compensate for the limitations that the disability from a SCI can bring. As we have become reliant on digital media, communication devices and computers; returning to use of these items is often a primary goal for patients with a SCI. Due to time constraints, funding challenges, knowledge gaps in clinical staff and limited access to technology in the hospital setting, access for persons with SCI to technology that is adapted to their needs is critically delayed and limited.

Significance for SCI practice: The goal was to return individuals to using technology to their satisfaction during a 30-day program (AT Boot Camp) and home visit follow up. Twenty participants were enrolled in the AT Boot Camp. Participants were provided a comprehensive AT evaluation from a qualified physical or occupational

therapist. Pre and post assessments of quality of life were used including the Return to Normal Living Index and Casa Colina AT confidence assessment tool. Participants were scheduled for 8 visits of 1-2 hours with a physical or occupational therapist for an opportunity to practice using technology and other assistive devices within a 30-day time period. Following the completion of these visits, participants were offered a \$200 stipend towards the purchase of AT equipment and an in-person or remote home assessment to assist with set up and use of AT equipment purchased for home use. A 3-month follow up to assess participants continued use of the recommended and/or purchased equipment was completed.

Conclusion / Summary: This approach has shown to be highly feasible with a demonstrated need in our rehabilitation continuum of care. The patients who have participated have reported improved the quality of life and ability to successfully use or return to using technology. The use of the \$200 stipend per participant has been very helpful in assuring the participants have access additional non-insurance funded technologies. Significant funding and education is needed for staff and facilities that do not have an established AT program.

4 Automatic detection of destabilizing wheelchair conditions for modulating actions of neuroprostheses to maintain seated posture

Kiley Armstrong^{1,3}, Musa Audu^{1,3}, Ronald Triolo^{1,2,3}

¹Case Western Reserve University Department of Biomedical Engineering, Cleveland, OH, USA; ²Case Western Reserve University Department of Orthopedics, Cleveland, OH, USA; ³Louis Stokes Cleveland VA Medical Center, Research Department, Cleveland, OH, USA

Objective: Nearly 42% of adverse events after spinal cord injury (SCI) are caused by wheelchair tips and falls. Constant neural stimulation of the otherwise paralyzed core, hip, and trunk muscles can stabilize seated posture and return users to erect sitting positions in response to applied disturbances. The goal of this study is to automatically detect potentially destabilizing conditions encountered by manual wheelchair users and activate appropriate muscles to prevent falls and provide stability.

Design: Wireless inertial measurement units with tri-axial acceleration and gyroscopic sensors were fixed on the wheelchair frames and backs of two individuals with low cervical and thoracic level injuries. An algorithm utilizing the accelerometer and gyroscopic data was created to detect and classify a turn and a collision, and trigger appropriate stimulus patterns. Acceleration in the anterior and posterior (A/P) and angular velocity in the superior and inferior (S/I) direction provided distinct features to discriminate between potentially destabilizing collisions and turns, respectively.

Methods: Subjects sat passively in a manual wheelchair attached to a guidance track as it descended a ramp to ensure consistent velocity through a sharp 90° turn and sudden stop simulating a collision. During calibration trials, collision thresholds were computed by taking the mean of the maximum A/P acceleration peak from 20 trials and subtracting two standard deviations. The turn thresholds were computed in the same way with the S/I angular velocity. During testing, the algorithms were applied in real time to enable a pre-programmed activation pattern to oppose lateral bending or prevent forward leaning and maintain erect posture throughout the events.

Results: Subjects rated their perceptions of safety with and without stimulation via the Usability Rating Scale (URS). Subjects reported a mean URS score of 1.3 ± 1.1 with and -1.63 ± 0.4 without stimulation for collisions and a mean URS score of 0 ± 0.8 with and -1.37 ± 0.49 without stimulation for turns.

Conclusion: These ratings indicate a significantly increased feeling of safety and stability during turns and collisions when stimulation was automatically applied to the appropriate muscles to resist potentially destabilizing events.

Support: Rehabilitation R&D Service of the US Department of Veterans Affairs Merit Review 101RX001204 and Spinal Cord Research Program of the US Department of Defense Grant SC090230.

5 Autonomic dysreflexia elaborated: new details emerging from statistical analysis

Ryan Solinsky^{1,2}

¹Kessler Institute for Rehabilitation, West Orange, NJ, USA; ²Rutgers New Jersey Medical School, Newark, NJ, USA

Background: Autonomic dysreflexia (AD) is a well-known complication of spinal cord injury (SCI), characterized by a potentially dangerous progressive hypertension. However, some ambiguity exists regarding presentation, evolution over time, and source-related treatments. This uncertainty can delay essential management.

Research design: Analysis of a large prospectively gathered AD dataset.

Methods: Descriptive statistics were utilized to identify the frequency of tachycardia vs. bradycardia during AD, the effect of chronicity of SCI on response to standardized pharmacologic treatment of AD, the effectiveness of supplemental opioids in treating suspected nociceptive pain mediated AD, the response to nitroglycerin ointment in suspected bladder related AD.

Results: 445 episodes of AD recorded in 78 patients were analyzed. The frequency of tachycardia and bradycardia with AD were 68.0% and 0.3% respectively. A strongly matched positive linear correlation was identified between the duration of pharmacologically treated AD episodes and chronicity of SCI ($R^2=0.83$). The addition of opioids to an antihypertensive medication protocol did not significantly decrease AD episode duration or magnitude of systolic blood pressure (SBP) decrease in suspected cases due to nociceptive pain. Bladder related AD episodes treated with nitroglycerin ointment had a faster onset of action (10.8 minutes vs. 15.9 minutes), faster time to reach below 160 mmHg SBP (16.5 minutes vs 20.9 minutes), and greater decrease in SBP (84.3mmHg vs. 68.6mmHg) than non-bladder related episodes ($P=0.19$, 0.23 , and 0.02 respectively).

Conclusions: Autonomic dysreflexia more commonly occurs with tachycardia. While further investigation is needed on the effects of chronicity of SCI and pharmacologic management, this study provides greater understanding of clinical signs and treatment variables of AD after SCI.

6 Beyond the AIS: the potential of defining incompleteness of injury with neurophysiology

Kelsey A. Potter-Baker^{1,2}, Frederick Frost^{3,4,5}, Ela B. Plow^{1,3}

¹Department of Biomedical Engineering, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA; ²Advanced Platform Technology Center, Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, OH, USA; ³Department of Physical Medicine and Rehabilitation, Neurological Institute, Cleveland Clinic Foundation, Cleveland, OH, USA; ⁴Center for Spine Health, Cleveland Clinic Foundation, Cleveland, OH, USA; ⁵Department of Rehabilitation and Sports Therapy, Cleveland Clinic Foundation, Cleveland, OH, USA

Objective: To determine if neurophysiology can more objectively define incompleteness of injury and predict impairment in comparison to the AIS scale.

Design: A longitudinal design across patients undergoing rehabilitation (NCT01539109).

Participants/methods: Eight male subjects with chronic incomplete spinal cord injury (iSCI) were enrolled. All subjects were classified as American Spinal Cord Injury Association (ASIA) Scale (AIS) D. We defined incompleteness of injury in patients using transcranial magnetic stimulation (TMS). Incompleteness was expressed as the difference in excitability of corticospinal pathways devoted to a muscle located above and below injury (expressed as a % maximum stimulator output (MSO). We used manual muscle test, upper extremity motor score (UEMS), and nine hole peg test (NHPT) to evaluate the amount of functional impairment in each subject. Linear regressions were used to determine if incompleteness of injury was related to baseline functional impairment; significance was defined as $P<0.05$.

Results: We found that functional impairment was extremely variable within the cohort of AIS D subjects.

Similarly, incompleteness of injury as defined by TMS greatly varied among AIS D subjects. The amount of incompleteness, as assessed by TMS, ranged from no difference in excitability between a muscle located above and below injury and a difference of 45 %MSO. Incompleteness of injury as defined by TMS was related to baseline clinical impairment; wherein those with a less incomplete injury demonstrated a poorer UEMS ($r=0.55$; $P<0.05$), decreased manual muscle test grade ($r=0.619$) and reduced hand function ($r=0.66$; $P<0.03$). No significant relationships between AIS and impairment were noted.

Conclusion: Current classifications of incompleteness of SCI are unable to identify mechanisms of recovery due to large within-category variability from simple scales (e.g. AIS grade). One powerful tool that may be able to provide a more objective insight is TMS. Here, we have found that incompleteness of injury defined with TMS can more significantly relate to baseline dysfunction in comparison to the AIS scale. Collectively, our results suggest that TMS may serve as a more powerful tool than standard clinical examinations to prognosticate baseline function and likely recovery potential after SCI.

Support: Work was funded by DoD W81XWH1110707 to EBP and FF, and RPC 2016-195 to KPB.

7 Causes of VA and non-VA hospitalization in the first year after acute rehabilitation

Sujuan Cai^{1,2}, Debra Berkajian², Heejung Bang², Jenny B Kiratli¹, Doug Ota¹

¹VA Palo Alto Health System Spinal Cord Injury/Disorder Center, Palo Alto, CA, USA; ²The Betty Irene Moore School of Nursing, University of California at Davis, Sacramento, CA, USA

Objective: To identify rates and causes of re-hospitalizations at VA and non-VA hospitals in California during the first year after discharge from acute rehabilitation (AR) at our VA Spinal Cord Injury & Disorders (SCID) Center

Design: Retrospective cross sessional cohort study

Methods: 300 Veterans were identified who had received initial AR at our VA SCID Center from 1999 to 2014. 47 Veterans were excluded due to discharge outside California as the essential follow-up data unavailable. Data on hospital admissions including reason, diagnosis, dates and disposition were abstracted from VA records and the California Office of Statewide Health Planning & Development (OSHPD) database. OSHPD maintains information on all hospitalizations at non-federal hospitals in California. Full social security number, dates of birth, and dates of discharge were given to a VA data extractor and a dual contractor of VA/OSHPD to extract both VA and non-VA hospitalization data during the first year after discharge. The data were analyzed by Stata 13.0.

Results: 50.2% of Veterans were hospitalized at least once with mean of 1.13 ($SD\pm 1.56$) occurrences. VA hospitalizations were primarily for non-urgent reasons including 56% for wellness or preventive stays (eg, annual evaluation, 3-month follow up, continue rehab or procedures-related admission such as colonoscopy or urodynamic studies) and 11.6% for social/respite admissions for caregiver relief or awaiting long-term placement. The remaining VA hospitalizations were for psychiatric (6.3%) and episodic (26.2%) admissions. Mean length of stay (LOS) was 37.4 days ($SD\pm 305.7$). By contrast, all non-VA hospitalizations were for episodic admissions, mean LOS of 2.7 days ($SD\pm 8.5$). The top 3 diagnoses of VA episodic hospitalization were nervous system (26%), skin and infectious diseases (16%), and infectious & parasitic diseases (10%). By contrast, the top 3 diagnoses of non-VA hospitalization were respiratory (20.1%), kidney and urinary tract (17.5%), and nervous system (12.4%).

Conclusion: Approximately half of Veterans with SCID are re-hospitalized at least once during the first year post AR. However, length and causes are different for VA vs non-VA hospitalizations. Hospitalization at VA are longer (14x) and primarily preventive or related to social issues which reflects VA provision of a security net for Veterans with SCID.

Support: Funding from Bay Area & Western Chapter of PVA for data linkage fee

8 Clinician wheelchair skills training using self-study and remote asynchronous feedback

Lynn Worobey¹, R. Lee Kirby²

¹University of Pittsburgh, Pittsburgh, PA, USA; ²Dalhousie University, Halifax, NS, Canada

Objective: Many wheelchair users lack skills crucial for independence, safety and upper limb preservation. A lack of knowledge on the part of the clinician in terms of how to deliver training is a potential barrier to delivery. In the current digital age, web training offers an opportunity for clinicians to access such training remotely. The goal of this study was to evaluate the effectiveness of self-study complemented by remote asynchronous feedback to increase clinician capacity and confidence in performing wheelies and curb negotiation.

Design: Prospective cohort of 4 physical therapy students with ≤ 1 year experience with wheelchairs.

Participants/methods: Participants were provided with an electronic copy of the Wheelchair Skills Program Manual and instructed to review the introduction to wheelchair skills training, spotter safety, and sections on 10 intermediate and advanced skills. Instructional videos were provided for each skill. Participants were told to practice the skills in pairs, over 3-4 weeks with self-selected frequency and duration of sessions. After each session, participants uploaded a training log and videos of themselves practicing. Feedback was provided asynchronously by a content expert from Dalhousie University within 1-2 days on spotter technique and difficulties identified in the video recordings. Before and after training, participants completed the Wheelchair Skills Test Questionnaire (WST-Q) to indicate their capacity and confidence.

Results: Participants completed 4-5 training sessions that lasted 30-90 minutes. Participants improved in the 10-items of the WST-Q training was provided on for capacity (32.7.0% to 73.0%, $P=0.04$) and confidence (46.0% to 77.1%, $P=0.029$). At the conclusion of training, all skills could be completed with full confidence except for the moving wheelie down a curb and ramp, both of which are advanced skills that were only achieved by 50% of the participants. Participants felt the training was useful, relevant, easily tolerated and understandable. Challenges of the intervention for the expert providing feedback included timing and content of feedback, video orientation, and limited interaction with participants.

Conclusion: Self-study complemented by remote asynchronous feedback was effective in increasing confidence and capacity to complete wheelies and curb negotiation. This model can be further investigated as a delivery method for improving knowledge translation of wheelchair skills training.

Support: NIDILRR grant 90DP0025

9 Comparing travel barrier perceptions of persons with SCI and caregivers

Ozen Bas¹, Shu Cole¹, Susan Charlifue², Gale Whiteneck²

¹Indiana University, Bloomington, IL, USA; ²Craig Hospital, Englewood, CO, USA

Objective: Understand the perceived difference in barriers to travel between PwSCI and their caregivers.

Design: From May to September of 2015, in-depth semi-structured telephone interviews were conducted to gather information on the facilitators and barriers to travel.

Participants/methods: The study included 39 individuals with SCI who were enrolled in the Rocky Mountain Regional Spinal Injury System, and 23 caregivers. The interviews were coded quantitatively by counting the frequencies each travel barrier is mentioned. This allows us to not only statistically identify the more voiced barriers but also detect the response patterns of respondents.

Results: In general, PwSCI and caregivers agreed the travel barriers. However, PwSCI were more concerned about the physical barriers and personal discomfort, while caregivers focused more on other's attitudes toward their loved ones and how their loved ones would react to the negative attitudes. The top three barriers

reported by PwSCI include inaccessible infrastructure, difficult access to airplanes, and personal discomfort during travel. The top three barriers mentioned by the caregivers are the psychological state of the individual with SCI, parking issues, and systemic ignorance and negative attitudes of the public toward people with disabilities. To compare the specific responses of an individual with SCI and their travel companion, paired samples t-tests were employed. Results reveal that PwSCI perceived poor service performance of service providers (e.g. not knowing how to handle wheelchairs) as more important than their caregivers did. The general public's lack of knowledge about accessibility and their negative attitudes towards PwSCI (e.g. stigmatization and stereotyping) was more important to caregivers than to PwSCI.

Conclusion: Although caregivers and PwSCI travel together, and they agreed on the barriers PwSCI experience during travel, what they consider as the most important barriers may be different from each other.

Support: This project is funded by the Craig H. Neilsen Foundation (Project #321788).

10 Considering weight management for people with SCI

Katherine Froehlich-Grobe¹, David R. Gater^{2,3}, Melany Greathouse¹

¹Baylor Institute for Rehabilitation, Dallas, TX, USA; ²Penn State College of Medicine, Hershey, PA, USA

³Penn State Hershey Rehabilitation Hospital, Hershey, PA, USA

Objective: This panel will delve into a common, but often overlooked issue affecting the health and function of people with spinal cord injury (SCI), their weight status. The panel will highlight the current evidence base around weight management and metabolic syndrome plus describe current initiatives within one inpatient rehabilitation setting and generate discussion about addressing these issues within clinical practice. These topics will be addressed by three panel speakers. Dr. Froehlich-Grobe will present 6-month interim results from a weight loss study. Dr. Gater will review the importance of body composition in characterizing neurogenic obesity and its relationship to the metabolic syndrome in SCI, plus discuss practical applications of energy balance (exercise and nutrition) to promote fat loss. Ms. Greathouse will discuss using functional groups to address nutrition education, meal planning and preparation in the inpatient rehabilitation setting, plus community wellness initiatives.

Design: Randomized controlled trial, with wait-list control group. Body weight was measured at a rehabilitation hospital at baseline, 3, and 6 months and data were combined for both intervention groups.

Participants/methods: 32 SCI community-dwelling participants enrolled in the Group Lifestyle Balance Adapted for Impaired Mobility (GLB AIM), a weight-loss program adapted to address issues facing individuals with mobility impairment. Participants attended 13 weekly sessions, delivered through in person (1x/month) and by teleconference, plus 4 biweekly sessions. Repeated measures analysis of variance was conducted with the combined SCI group.

Results: The middle-aged sample (48 ± 11 years) included equal numbers of men and women with an initial average BMI of 33 ± 7 . Session attendance averaged 69% and 56% self-monitored their daily food intake. Two-thirds (69%) returned for 3 weight measurements over 6 months. These participants experienced significant weight loss ($P=0.019$) that averaged 4 kg.

Conclusion: Given the prevalence of overweight and obesity among people with SCI and the serious negative effects on health and function, it is important to focus clinical and research efforts on this issue. Current promising efforts that target the issue can be expanded and new initiatives considered.

Support: The GLB AIM was supported by the Disability and Research Dissemination Center (DRDC) through its Grant Number 5U01DD001007 from the Centers for Disease Control and Prevention (CDC).

11 Correlates of post-traumatic growth following spinal cord injury/disorder

Bella Etingen¹, Scott Miskevics¹, Sherri L. LaVela^{1,2}

¹Center of Innovation for Complex Chronic Healthcare (CINCCH), Department of Veterans Affairs, Edward Hines Jr. VA Hospital, Hines, IL, USA; ²Department of Physical Medicine and Rehabilitation, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA

Objective: Our objective was to determine ‘static’ (non-modifiable) and ‘dynamic’ (modifiable) factors independently associated with post-traumatic growth (PTG) (e.g., positive psychological responses following trauma) in persons with a spinal cord injury/disorder (SCI/D).

Design: Cross-sectional mailed survey.

Participants/methods: Surveys were sent to a nation-wide sample of Veteran VA healthcare users with SCI/D in 2014-2015 and provided: ‘static’ factors (demographics, injury characteristics), ‘dynamic’ factors (select health conditions, sleep disturbance, grief/loss, pain behavior, pain interference, independence, social support, social participation, resilience, self-efficacy), and PTG. Bivariate comparisons assessed differences between respondents with high (≥ 50) vs. low (< 50) PTG. Multivariate linear regression assessed factors independently associated with PTG.

Results: Respondents ($n=876$) were predominantly male (93.6%) and white (79.2). Most had a paraplegic (62.3%) and incomplete (60.8%) injury. A lesser proportion of persons with high (vs. low) PTG had an incomplete injury (51.8% vs. 65.4%, $P=0.0004$) and prior-year: pain (57.0% vs. 70.9%, $P<0.0001$), problems sleeping (29.8% vs. 51.0%, $P<0.0001$), depression (12.2% vs. 39.2%, $P<0.0001$), and post-traumatic stress disorder (6.4% vs. 22.0%, $P<0.0001$). Respondents with high PTG reported lower sleep disturbance (46.8 vs. 53.7, $P<0.0001$), grief/loss (47.2 vs. 56.5, $P<0.0001$), pain interference (52.5 vs. 60.3, $P<0.0001$) and maladaptive pain behavior (52.7 vs. 59.2, $P<0.0001$), and higher independence (53.3 vs. 47.2, $P<0.0001$), social support (72.6 vs. 65.8, $P=0.0002$), social participation (47.6 vs. 41.2, $P<0.0001$), resilience (56.7 vs. 45.6, $P<0.0001$), and self-efficacy (49.2 vs. 41.5, $P<0.0001$). Multivariate analyses showed being married/cohabitating, and higher social participation and resilience were positively associated with PTG, while paraplegia and incomplete injury were negatively associated with PTG.

Conclusion: Establishing effective coping methods early in rehabilitation are integral to effective post-injury adjustment over time. Rehabilitation efforts should include programs to bolster dynamic outcomes that may lend to PTG (e.g. participation, resilience, healthy relationships).

Support: Department of Veterans Affairs, Office of Research and Development, Health Services Research and Development, Quality Enhancement Research Initiative (RRP-13-248).

12 Do barriers and facilitators predict travel participation?

Shu Cole¹, Noah Hoback¹, Gale Whiteneck²

¹Indiana University School of Public Health, Bloomington, IN, USA; ²Craig Hospital, Englewood, CO, USA

Background: Although the International Classification of Functioning, Disability and Health conceptualizes disability as the outcome of a person’s health conditions as well as personal and environmental barriers and facilitators, there is little empirical evidence of the predictive power of these environmental factors on participation. The purpose of this study is to empirically examine the influences travel barriers and facilitators exert on travel participation.

Design/Methods: Structured surveys were administered to individuals enrolled in the Rocky Mountain Regional Spinal Injury System who were due for an injury anniversary interview from February 2016 to February 2017. A total of 153 surveys were completed. A barriers index (total score on 19 barriers) and a facilitators index (total score on 14 facilitators) were calculated for each participant. Correlation analysis and hierarchical regression analysis were conducted to determine whether barriers and facilitators predict travel participation.

Results: Correlation analysis shows that the number of trips taken in the past two years was not significantly correlated with neither the barriers index nor the facilitators index, but significantly correlated with one specific barrier (having to use the special chair to transfer into an airplane seat), and three facilitators (the internet, smartphone, and the ability to problem solve during travel). Hierarchical regression analysis reveals that other than “the internet,” all are significant predictors, explaining 17.4% of the variance in travel participation. For female travelers, two barriers (travel industry staff not knowing how to handle my

wheelchair, and lack of hotel rooms that accommodate wheelchair users) and one facilitator (the smartphone) explained 20.6% of the variance in travel participation. For male travelers, both “having to use the special chair to transfer into an airplane seat” and “the ability to problem solve during travel” were significant predictors and explained 15.1% of the variance in travel participation.

Conclusions: Travel barriers and facilitators were found to predict travel participation. Results of the study suggest that context-specific barriers/facilitators should be the level of analysis, and gender differences should be noted.

Support: The project is funded by Craig H. Neilsen Foundation (Project #321788).

13 Electrical stimulation to improve bowel function

Dennis Bourbeau^{1,2,3,4}, Steven Brose^{1,2,4,5}, Kelsey Aamoth⁶,
Kenneth Gustafson^{1,3,4,6}

¹Louis Stokes Cleveland Department of Veterans Affairs Medical Center, Cleveland, OH, USA; ²MetroHealth Medical System, Cleveland, OH, USA; ³Case Western Reserve University School of Medicine, Cleveland, OH, USA; ⁴Cleveland VA Functional Electrical Stimulation Center, Cleveland, OH, USA; ⁵Ohio University Heritage College of Osteopathic Medicine, Columbus, OH, USA; ⁶Case Western Reserve University School of Engineering, Cleveland, OH, USA

Objective: Neurogenic bowel dysfunction is a common concern for persons with spinal cord injury (SCI), which may result in slowed colonic motility, chronic constipation, and fecal incontinence. It adversely affects quality of life and typically requires rigorous bowel care routines, which often involves significant time expenditure for the individual and/or caregivers. We aim to develop an alternative approach using functional electrical stimulation to restore bowel function for persons with neurogenic bowel dysfunction. The objectives of this study were to determine if reflex colonic activity can be elicited by electrical stimulation of the colon and to identify the effect of stimulation variables, such as stimulation pattern and electrode location.

Design: Acute experiments were conducted in nine neutrally intact cats under chloralose anesthesia.

Methods: Proximal colon, distal colon, and rectum were electrically stimulated with continuous and burst patterns. Proximal colon, distal colon, and rectal pressures were recorded via balloon catheters. Pressure amplitude was the primary outcome measure, and rate of pressure change and onset delay were secondary measures.

Results: Electrical stimulation of the colon evoked localized colon contractions in the colon segment directly below the electrodes in all cats. Constant frequency stimulation produced ischemia and a tetanic colon contraction, but burst pattern stimulation at similar amplitudes did not alter tissue appearance, and colonic pressures increased more slowly. Colon pressures increased with increasing stimulus amplitude, frequency, pulse width, and burst number. Rectal stimulation did not evoke significant colon responses without affecting limb responses simultaneously. Proximal colon stimulation resulted in only proximal colon pressure increases. Distal colon stimulation generated both distal and proximal colon pressure increases. Isoflurane anesthesia eliminated proximal pressure responses and reduced distal pressure responses, suggesting that reflex pathways were activated via distal colon stimulation.

Conclusion: Colonic pressures can be produced via both direct and reflex pathways using electrical colon stimulation. A neural stimulation approach has the potential to improve colonic motility. Further preclinical work is needed, including study of SCI animal models, prior to translation to human clinical research.

Support: Dept. of Veterans Affairs RX000822, RX000960, and RX001962.

14 Exoskeleton assisted walking (EAW) in acute rehabilitation following spinal cord injury

Kyle McIntosh

Foothills Medical Centre, Calgary, AB, Canada; University of Calgary, Calgary, AB, Canada

Objective: To describe the protocol development, training strategies and early study results of Exoskeleton Assisted Walking (EAW) in acute (<6 months) SCI (spinal cord injury).

Background: Motor recovery rates tend to be the fastest in the first several months post (Hallet, 2005) and locomotor training is used when possible. EAW enables stepping and walking in high doses with low user and therapist exertion, yet there is no known published data on safety/feasibility and protocol for acute SCI use.

Design: Prospective case series

Participants/methods: An EAW training protocol was established to determine EAW safety/feasibility in acute SCI. 5 participants were recruited from a Level 1 trauma center in a major Canadian city. Participants trained in 1 hour sessions for a total of 25 hours while being evaluated for vitals, skin integrity, pain, perceived exertion, falls, spasticity and gait parameters. Inclusion criteria included; age 15 and older, AIS A through D SCI within the last 6 months, deemed medically stable as well as meeting the manufacturers specifications for body metrics, range of motion and spasticity. Any potential participant outside of those criteria were excluded as well as those who were unable to tolerate standing, had uncontrolled spasticity or autonomic dysreflexia.

Results: Four out of five participants completed the protocol with no falls or skin breakdown. All 4 demonstrated improved gait outcomes. Pain and perceived exertion levels were low and moderate respectively and participants tolerated hour-long training sessions in spite of early and occasional orthostatic hypotension. One participant withdrew from the study without completing any walking sessions.

Conclusion: EAW is both safe and feasible in acute SCI rehabilitation.

Support: Financial support by Calgary Health Trust, University of Calgary Cumming School of Medicine/ Hotchkiss Brain Institute, Alberta Paraplegic foundation. Facilities support provided by Alberta Health services.

15 Factors impacting extent of implementation of a pressure ulcer intervention

Jennifer N. Hill¹, Marylou Guihan^{1,2}, Hira Khan^{1,2}, Susan Thomason³,
Gail Powell-Cope^{4,5}, Barbara Bates-Jensen^{1,6,7}

¹Center of Innovation for Complex Chronic Healthcare (CINCCCH), Department of Veterans Affairs, Edward Hines Jr. VA Hospital, Hines, IL, USA; ²Northwestern University, Department of Physical Medicine and Rehabilitation, Feinberg School of Medicine, Chicago, IL, USA; ³Tampa VA Research and Education Foundation, Tampa, FL, USA; ⁴Center of Innovation for Disability and Rehabilitation Research, James A. Haley Veteran's Hospital, Tampa, FL, USA; ⁵University of South Florida, School of Nursing, Tampa, FL, USA; ⁶University of California-Los Angeles, School of Nursing, Los Angeles, CA, USA; ⁷University of California-Los Angeles, David Geffen School of Medicine, Los Angeles, CA, USA

Objective: To evaluate implementation of the Spinal Cord Injury Pressure Ulcer Monitoring Tool (SCI-PUMT) in Veterans Health Administration (VHA) SCI Centers.

Design: Observational.

Participants/methods: Interviews were conducted with members of SCI wound care teams at 7 VA SCI Centers that self-reported as high (n=1), medium (n=3), and low (n=3) adopters. Initial analysis was conducted using inductive thematic coding and a second level of synthesis was conducted to explore the barriers and facilitators that emerged during implementation of the SCI-PUMT using the Consolidated Framework for Implementation Research (CFIR).

Results: Members of SCI wound care teams across the 7 sites participated (n=49). Findings are organized using CFIR domains [italicized] and constructs [in brackets]. (1) *Intervention Characteristics*: Adaptability of the intervention to local context was noted as important [adaptability], but that value and impact [relative advantage] would be improved by redesigning the form for user-friendliness [design quality and package]. (2) *Patient Needs and Resources*: All sites indicated that understanding patient needs/circumstances and patient engagement were facilitators. (3) *Inner Setting*: Interdisciplinary team meetings, open communication, and a collaborative approach to wound care facilitated adoption [structural characteristics], while low-

adopting sites reported that weak participation, resistance and /or lack of interest in the wound care process by some providers hindered adoption [culture]. (4) *Characteristics of the Individual*: Higher adopting sites with individuals who were knowledgeable and enthusiastic about the intervention's potential value for patients [knowledge and beliefs] experienced more success [self-efficacy]. (5) *Process*: Higher adopting sites reported completing staff training, incorporating technology, integrating the SCI-PUMT into existing practices [planning], incorporating staff input [engagement], and engaging in ongoing discussions about implementation [evaluation].

Conclusion: Taking the lessons learned, especially understanding the negative and positive influences impacting implementation, provides insight into what works where and why and will help promote uptake and dissemination of the SCI-PUMT in other settings.

Support: This project was supported by the VA HSR&D Quality Enhancement Research Initiative (QUERI) program via a Rapid Response Proposal (RRP) 12-561 and by the VA SCI National Program Office.

16 Fall characteristics of fulltime wheelchair users living with spinal cord injury

Laura A. Rice¹, Jong Hun Sung¹, Yarden Trace¹, Elizabeth W. Peterson², Jacob J. Sosnoff¹

¹Department of Kinesiology and Community Health, University of Illinois, Urbana, IL, USA; ²Department of Occupational Therapy, University of Illinois at Chicago, Chicago, IL, USA

Objective: Falls are a common concern for individuals living with spinal cord injuries (SCI). Between 30-50% of wheelchair users with SCI have experienced a fall that can result in injuries including fractures or concussions. Falls may also lead to concerns about falling that can negatively impact quality of life, community participation and the ability to perform essential activities of daily living. As a result, our research team examined characteristics of falls sustained by full time wheelchair users living with SCI in order to better inform treatment strategies to manage fall risk.

Design: Interview.

Participants/methods: To examine fall characteristics, participants who had a self-reported diagnosis of SCI, over 18 years old, used a wheelchair as their main form of mobility (>40 hours per week), self-reported an inability to ambulate outside of their home and experienced at least one fall in the past six months were invited to our laboratory to participate in a short interview. After signing an IRB approved consent form, participants were asked to describe the circumstances associated with their most recent fall.

Results: Participants were an average age of 37 ± 15 years old, lived with a SCI for an average of 23 ± 18 years and sustained an average of 3 falls in the previous 6 months. The majority of participants ($n = 21$, 91%) used a manual wheelchair for 20 ± 16 years. During the thematic analysis of the description of the most recent fall, 3 main categories emerged: (1) Movement-related fall contributors, (2) location of falls, and (3) Fall attributions. Results indicate that the most common movement being performed at the time of the fall was a transfer ($n = 11$, 50% of reports). Participants reported that falls most frequently occurred in the bathroom ($n = 7$, 33% of reports) or the street ($n = 7$, 33% of reports). Finally, the most common fall attribution was surface condition, such as a wet surface or a crack in the sidewalk.

Conclusion: Our findings afford clinicians and researchers a greater understanding of the circumstances associated with falls to better inform treatment interventions. In addition, our findings indicate that many of the fall characteristics commonly reported can be managed through therapeutic interventions and education. Our research provides important preliminary data to manage a significant area of concern for individuals living with SCI.

Support: Craig Neilsen Foundation

17 Functional status predicts readmission in the spinal cord injury population

Donna Huang^{1,2}, James W. Morgan^{1,2}, Chloe Slocum^{1,2}, Richard Goldstein^{1,2}, Jeffrey C. Schneider^{1,2}

¹Department of Physical Medicine and Rehabilitation, Spaulding Rehabilitation Hospital, Boston, MA, USA;

²Harvard Medical School, Boston, MA, USA

Objective: To evaluate functional status as a risk predictor of readmission in the spinal cord injury population.

Design: Retrospective cross-sectional analysis.

Participants/methods: A retrospective analysis of data from the Uniform Data System for Medical Rehabilitation from 2002 to 2011 was performed examining spinal cord injury patients admitted to inpatient rehabilitation facilities. A logistic regression model for predicting acute care readmission based on age and functional status (Functional Model) was compared with models incorporating functional status and medical comorbidities (Functional-Plus) or models including age and medical comorbidities alone (Age-Comorbidity). Functional status was measured using the Functional Independence Measure (FIM) and medical comorbidities were captured with the Charlson-Deyo comorbidity index, Elixhauser comorbidity index, and the Medicare comorbidity tier system. The primary outcomes were three and thirty-day readmission after admission to inpatient rehabilitation, and the primary measure of model performance was the c-statistic. We hypothesized that functional status is a more robust predictor of readmission in the spinal cord injury population compared with medical comorbidities.

Results: There were a total of 68,395 patients with 1,469 (2.15%) readmitted at three days and 7,081 (10.35%) readmitted at thirty days. The c-statistics for the Functional Model were 0.702 and 0.654 for three and thirty days respectively. The Functional Model outperformed all three Age-Comorbidity models at three days (c-statistic difference: 0.072-0.104) and outperformed two of the three Age-Comorbidity models at thirty days (c-statistic difference: 0.031-0.059). The best-performing Functional-Plus models exhibited negligible improvements in model performance compared to the Functional models, with c-statistic improvement of only 0.000 to 0.010.

Conclusion: Readmissions have been increasingly used as a marker of hospital performance, with financial penalties to hospitals for excessive readmissions. Function-based readmission models in the spinal cord injury population outperform models incorporating medical comorbidities. Readmission risk models for this population would benefit from the inclusion of functional status as a primary predictor.

18 Injury epidemiology of spinal cord injured participants in the National Veterans Wheelchair Games

Venessa Lee¹, Lauren Rudolph¹, Maseru Teramoto¹, Carolyn Campbell¹, Toni Roberts¹, Kenneth Lee²

¹University of Utah, Salt Lake City, UT, USA; ²Milwaukee VA Medical Center, Milwaukee, WI, USA

Objective: There are numerous health benefits for spinal cord injury (SCI) Veterans from participation in adaptive athletic competition. To ensure the safety of athletes, assessing risk of injury and providing medical care is critical. Injury data has been reported on wheelchair athletes at Paralympic Games. No study known to the authors has been published reporting injury epidemiology of the National Veterans Wheelchair Games (NVWG). The purpose of this study was to investigate incidence of injury and illness in the athletes with SCI at the 36th annual NVWG.

Design: Retrospective chart review of the Games incident records during the week of the NVWG. Injury and illness encounters for participants were registered in the Salt Lake City Veterans Affairs electronic medical record when evaluated during the Games. Data included age, sex, SCI level, chief complaint, diagnosis and treatment.

Methods: Visit encounters were divided into 7 categories based on chief complaint and diagnosis (bowel, bladder, skin, need for medical supplies, musculoskeletal injury, and other medical illness). Descriptive statistics were calculated for demographics, level of SCI and diagnosis. Proportion of injured participants by SCI level were compared using a z-test. A two-way contingency table analysis with a χ^2 test was conducted to examine the association between level of SCI and type of injury.

Results: There were 537 total participants, 264 of which had a SCI. A total of 111 SCI athletes sought medical care. Some athletes were seen multiple times thus medical personnel staffed a total of 162 encounters (106 paraplegic, 56 tetraplegic; 156 males, 6 females; mean age = 50.6 years). Most common complaint was injury to the skin (48 cases, 29.6%), then need for medical supplies and musculoskeletal injury (31 cases of each, 19.1% for both). The proportion of paraplegic participants who sought medical care (64.6% of paraplegic participants) and that of injured tetraplegic participants (56.0% of tetraplegic participants) were not significantly different ($Z = 1.392$, $P = 0.164$). There was no significant association between level of SCI and presenting complaint ($\chi^2 = 7.114$, $P = 0.212$).

Conclusion: Our findings increase understanding of medical needs at adaptive sporting events for SCI athletes. This knowledge emphasizes importance of future surveillance, development of prevention strategies, and preparedness with medical supplies and personnel at future events.

19 Interdisciplinary cross-training: spinal cord injury specialists for acquired brain injury

Kristen Lueck¹, Liz Pike²

¹Shepherd Center, Atlanta, GA, USA; ²Shepherd Center, Atlanta, GA, USA

Objective: Specialty rehabilitation hospitals typically address complex needs for persons with spinal cord injury (SCI) and acute brain injury (ABI) by training staff to become experts in care provision within separate programs. While clinician specialization may ensure best treatment delivery for patients with either SCI or ABI, it may also lead to clinician indecision and uncertainty when treating a patient with a dual diagnosis spinal cord and brain injury. Clinicians may lack confidence, training, and/or time to meet the needs of patients with dual diagnoses. This symposium will provide an example of how one center addressed this “silo-ed specialist” dilemma.

Methods: A Committee of SCI and ABI clinicians conducted extensive interviews with clinicians, management, and educators to identify issues such as limited time, safety, preparedness, and communication when dealing with dual diagnosis patients. The Committee identified successes in treating dual diagnosis patients to guide realistic clinical expectations of care. The outcome of this work included a two-part educational series and the creation of a simple daily bedside checklist to ensure patients' needs are identified on admission and care coordination occurs smoothly.

Clinicians completed a pre- and post-course Google survey asking [for dual diagnosis patients]: how prepared they felt to provide treatment and family training, how well patient/family needs are met, how well team member roles are defined, etc., using a 10-point Likert scale. Prior to part one education, 46% of staff reported feeling inadequately prepared to address family training needs compared to 25% after completion and 74% felt they understood patient/family needs compared to 88% after.

Summary: Part two of the educational series used issues identified in part one to improve staff education for evaluation, treatment planning, outcome expectations, family training, return to driving, discharge recommendations, and long term vocational challenges. This symposium will provide participants with increased awareness of the care provision challenges for patients with both SCI and ABI, the ability to identify areas for educational growth within their facility, and the frame-work for creating a similar process in clinical practice.

20 it's all in your head: driving cortical plasticity to improve muscle contraction below the level of injury

Kelsey A. Potter-Baker^{1,2}, Frederick Frost^{3,4,5}, Ela B. Plow^{1,3}

¹Department of Biomedical Engineering, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA; ²Advanced Platform Technology Center, Louis Stokes Cleveland Veterans' Affairs Medical Center, Cleveland, OH, USA; ³Department of Physical Medicine and Rehabilitation, Neurological Institute, Cleveland Clinic Foundation, Cleveland, OH, USA; ⁴Center for Spine Health, Cleveland Clinic Foundation, Cleveland, OH, USA; ⁵Department of Rehabilitation and Sports Therapy, Cleveland Clinic Foundation, Cleveland, OH, USA

Objective: To identify whether transcranial direct current stimulation (tDCS) paired with rehabilitation of paretic muscles can drive adaptive plastic changes in the brain that are related to improvements in muscle contraction below the level of injury in patients with cervical incomplete spinal cord injury (iSCI).

Design: Randomized, sham-controlled, double-blinded clinical trial.

Participants/methods: Twelve subjects with chronic iSCI (51.9 ± 4.1 y.o.) were enrolled and were randomly assigned to receive rehabilitation paired with either tDCS or sham stimulation for 5 days/week for 2 weeks. From pretest to posttest, we monitored changes in functional measures including: upper extremity motor score, action research arm test, manual muscle testing and nine-hole peg test. We also assessed cortical plasticity using transcranial magnetic stimulation (TMS). We determined the change of cortical representations devoted to muscles both caudal and rostral to the lesion. A linear mixed methods model was used for analysis, where significance was defined as $P < 0.05$.

Results: We found that subjects who received tDCS+rehabilitation, in comparison to sham, had notable increases in muscle contraction (improved medical research council (MRC) grade) for C5-T1 myotomes. Advantages for the tDCS+rehabilitation group in MRC grade were also found across the forearm and hand. Improvements in muscle contraction were related to plastic changes in the brain. Subjects in the tDCS+rehabilitation group demonstrated (1) a significant focal increase in the representation of a weaker muscle located below the level of injury (by 20%) and (2) a significant shift of the representation of a stronger muscle located above injury (~ 12 mm; $P < 0.05$).

Conclusion: Following iSCI, maladaptive reorganization occurs in the brain. Specifically, the motor cortex begins to lose cortical representations of weaker muscles while those of stronger, more spared segments magnify. Here, we have found that tDCS paired with massed practice rehabilitation can promote adaptive plasticity and help restore the representation of paralyzed/weak muscles. Further, incorporation of tDCS in rehabilitation resulted in improved functional outcomes in comparison to sham. Our findings suggest that tDCS+rehabilitation may be an effective technique to improve muscle contraction in paralyzed/weak muscles by alleviating maladaptive changes in the brain.

Support: Funded by DoD W81XWH1110707 to EP and FF, and RPC 2016-195 to KB.

21 Non-invasive spinal cord stimulation to improve hand function in SCI

Sujin Lee¹, Parag Gad², V. Reggie Edgerton²

¹Long Beach Veterans Affairs Spinal Cord Injury/Disorders System of Care, Long Beach, CA, USA; ²University of California, Los Angeles, Department of Integrative Biology and Physiology, Los Angeles, CA, USA

Objective: To evaluate the effectiveness of non-invasive electrical spinal cord stimulation on hand function improvement in individuals with chronic spinal cord injury (SCI).

Design:

Setting: University affiliated clinical study site.

Study design: a clinical prospective pilot study with therapeutic intervention.

Intervention: hand grip exercise with non-invasive SCS, 2 times a week for 4 weeks.

Outcomes: grip strength changes measured by dynamometer, EMG activity in forearm muscle groups upper

extremity motor score from ISNCSCI.

Participants/methods: Seven individuals with cervical SCI AIS B/C participated this study. They underwent medical and neurophysiological evaluation prior to the intervention. During the intervention period, participants underwent handgrip exercise with visual feedback using a dynamometer while non-invasive electrical SCS was provided on posterior neck, 2 times a week for 4 weeks. Grip strength changes were measured throughout the intervention session using dynamometer. ISNCSCI exam and EMG activity measurement in forearm muscles were performed in the beginning and at the end of the study.

Results: All subjects were capable of generating greater force with robust firing of distal (forearm) muscles in comparison to proximal muscle groups when exposed to multisite stimulation; compared to baseline measurements with single site stimulation or no stimulation. Over the course of the 4 weeks of intervention all subjects were capable of generating greater force with stimulation compared to without stimulation. Furthermore, over the course of the 4 weeks all subjects demonstrated a progressive increase in grip strength without any stimulation at the start of every session compared to their baseline. Along with an increase in maximal grip strength, all subjects demonstrated an increased capability to generate oscillatory movements as well.

Conclusion: This phenomenon is an important feature which impacts the quality of daily life for these individuals, that we believe will lead to further recovery enabling them to regain fine motor skills in carrying out certain activities of daily living such as grasping a cup of water to drink or holding a utensil to eat.

Support: NIH NIBIB SBIR 1R43E B017641-01

22 Novel assistive device as a training tool for spinal cord sailing simulator

Carolyn Campbell¹, Tara Mleynek², Benjamin Steele², Mitchell Kulina², Jacob Smith², Jesse Ferraro², Masaru Teramoto³, Vanessa Lee¹, Roger Alizer², Jeffrey Rosenbluth¹

¹University of Utah Hospital, Department of Physical Medicine and Rehabilitation, Salt Lake City, UT, USA;

²University of Utah Center for Medical Innovation, Department of Entertainment Arts Engineering, Salt Lake City, UT, USA; ³University of Utah, School of Medicine, Division of Physical Medicine & Rehabilitation, Salt Lake City, UT, USA

Objective: Many individuals with tetraplegia or paraplegia secondary to spinal cord injury (SCI) use sip-and-puff or joystick controllers to access mobility or personal devices, but their use for recreational sporting activities is limited. To address this, a novel customizable universal controller, Tetra Universal Controller (TUC), was developed to operate a TetraSail boat. Given limited access of this boat, a virtual sports simulation software called TetraSport was also created that mimics the controls and experience of the device. The aim of this study is to evaluate the training ability and patient experience using the TetraSport simulation software for adaptive sailing.

Design: This is an observational study conducted at a recreational sailing event to determine the experience of patients using TUC to operate virtual simulation and evaluate its role as a training tool. Qualitative analysis was utilized for data collected from observation, exit interviews, and objective task completion between three groups.

Participants/methods: Participants >18 years of age with a SCI were recruited at a single day recreational event. Selected individuals (n=13) were consented and divided into three groups: group one used only simulator (n=5), group 2 used simulator then sailed (n=4), and group 3 sailed then used the simulator (n=4). A χ^2 goodness-of-fit test was used to examine if participants felt that the simulator helped to prepare them for actual sailing.

Results: All participants reported an increase in both ability to operate the TetraSport simulator and enjoyment of its use. None reported discomfort or stress with simulation, with one user reporting relief of stress. There was no significant difference in the proportions of people who felt and those who did not feel that the simulator helped to prepare them for actual sailing (P=0.368).

Conclusion: The use of this virtual simulator appears to be an enjoyable and effective training device to improve

the experience and perceived ability of operation of the TetraSail. The customizable controller has the potential for application to a vast array of activities and may provide novel ways for improved quality of life in patients with SCI. These pilot study results are promising and highlight the need for more in-depth research in the area of adaptive recreational mobility devices.

Support: Support was provided by the Craig H Neilson Foundation.

23 Paired stimulation to improve hand muscle transmission and function after SCI

Sana Saeed¹, Tiffany M. Santiago¹, Matthew T. Maher¹, Yu-Kuang Wu¹, Noam Y. Harel^{1,2}

¹James J Peters VA Medical Center, Bronx, NY, USA; ²Icahn School of Medicine at Mount Sinai, New York, NY, USA

Background: In individuals with spinal cord injury (SCI), the connection between the upper and lower motor neurons is damaged, but some portion of neural tissue remains. We aim to improve function of spared neural tissue. Previous research has shown the efficacy of invasive electrical stimulation (i.e. epidural) in eliciting lower motor neuron activation after SCI. To establish a non-invasive method for activating remaining nerve fibers in cervical spinal cord, we tested pairs of two different types of electrical stimulation with transcranial magnetic stimulation (TMS). Depending on stimulation timing, the combination of electrical and magnetic stimulation is expected to strengthen cervical neural transmission and increase hand dexterity.

Design: Single-blind pilot clinical crossover study.

Methods: We recruited individuals with chronic SCI and non-disabled (ND) volunteers. 4 participants with SCI and 10 ND participants have undergone 1 Baseline and 7 intervention sessions with varying pulse timing and stimulation combinations. Electromyographic outcomes such as TMS motor-evoked potentials (MEP) and clinical outcomes of pinch strength and finger agility are measured.

Results: In baseline experiments combining *single* pulses of TMS with subthreshold cervical electrical stimulation (CES), we observed a timing-dependent two-fold increase in TMS MEP amplitude of the abductor pollicis brevis (thumb) muscle. In intervention experiments combining *repetitive* pulses of different stimuli, we observed a non-specific increase in MEP amplitude for up to 30 minutes after multiple interventions. After repetitive combinations of CES paired with TMS, performance on a finger agility task tended to improve in ND volunteers but not in the first four participants with SCI.

Conclusion: We hypothesized an improvement in synaptic transmission after interventions pairing two types of electrical stimulation with TMS at varying time intervals. The electrophysiological response of the targeted hand muscles exhibited a non-specific increase in amplitude after *repetitive* combined stimuli at *suprathreshold* levels, and a timing-specific increase after *single* combinations of stimuli at *subthreshold* levels. Hand dexterity tended to increase in ND participants. Lack of similar response in participants with SCI could be due to fewer participants with varying lesion levels. Analysis of other outcomes is ongoing.

Support: New York State Department of Health: Grant# C30599

24 Patient-reported bladder management improvements after exoskeletal-assisted walking

EunYoung Hong¹, Steven Knezevic¹, Pierre Asselin¹, Christopher M. Cirnigliaro¹, Stephen Kornfeld^{1,2,5}, Peter H. Gorman³, Gail Forrest⁴, William A. Bauman^{1,5,6}, Ann M. Spungen^{1,5}

¹Spinal Cord Damage Research Center, James J. Peters VA Medical Center, Bronx, NY, USA; ²Spinal Cord Injury Service, James J. Peters VA Medical Center, Bronx, NY, USA; ³University of Maryland School of Medicine,

University of Maryland Rehabilitation and Orthopedic Institute, Baltimore, MD, USA; ⁴Kessler Foundation, West Orange, NJ, USA; ⁵Departments of Rehabilitation Medicine, Icahn School of Medicine at Mount Sinai, New York, NY, USA; ⁶Department of Medicine, Icahn School of Medicine at Mount Sinai, New York, NY, USA

Background: People with spinal cord injury (SCI) have difficulties with bladder management. Depending on level and completeness of SCI, the bladder may be spastic, flaccid or a combination, resulting in time consuming care and unwanted voiding accidents or leakage between catheterizations. The SCI-QOL Physical-Medical Health Domain has a short form for Bladder Management Difficulties. The influence of physical activity on bladder management and function in persons with SCI is largely unknown. The purpose of this study was to determine the effect of the three months of Exoskeletal Assisted Walking (EAW) on bladder management/function in people with chronic SCI.

Design: A randomized two-group, crossover study design was employed.

Methods: Fourteen participants with SCI were randomized to either EAW or usual activity (UA) first followed by crossover to the other intervention. Participants received 36 sessions of EAW over 12 weeks followed or proceeded by 12 weeks of UA. Patient-reported outcomes from the bladder SCI-QOL questionnaire (PRO bladder) were performed three times (baseline, at crossover, and after completion). A five-point decrease was considered to be clinically meaningful. The data was analyzed using Wilcoxon Signed Rank test and paired *t*-tests.

Results: The mean age of all participants was 42 ± 16 years and the average duration of injury was 5 ± 5 years. There were four with tetraplegia and ten with paraplegia. A greater proportion of participants reported a clinically meaningful change in bladder management (50% vs. 14%, $P=0.059$) across their EAW intervention compared with their UA. Across the EAW intervention arm, there was an overall average of 3.1 ± 3.4 points improvement (55.5 ± 7.2 vs. 52.3 ± 7.3 , $P=0.008$) in the PRO bladder. There were no clinical differences between the tetraplegic and paraplegic individuals' responses.

Conclusion: Thirty-six sessions of EAW was associated with improved bladder management. These improvements included less interference with sleep, worry about an accident, limits to independence, and less time for bladder management functions. This preliminary work has implications for unexpected urologic quality of life improvements associated with EAW.

Support: Department of Defense/CDMRP SC130234 Award: W81XWH-14-2-0170 and National Center for the Medical Consequences of SCI (B9212-C, B2020-C) at the James J. Peters Veterans Affairs Medical Center.

25 Peer mentorship – integrating research paradigms into rehabilitation culture

Julie Gassaway, Pete Anziano

Shepherd Center, Atlanta, GA, USA

Objective: Summarize research results that validated the value of peer mentorship, as presented in the Audrey Nelson Lectureship at ASCIP 2016, and initiate discussion with audience participants on opportunities to translate research findings into actionable items and goals that impact current practice. Descriptions of how peer mentorship has been integrated into the full culture of rehabilitation at our center will assist participants in developing implementation goals to take back to home centers. Overall the goal is have peer mentorship become a major focal point of patient centered care, which has become the cornerstone of healthcare improvement initiatives.

Design: Translating randomized control trial of peer mentorship into rehabilitation practice.

Participants/methods: One hundred fifty-eight patients with SCI receiving inpatient rehabilitation were randomized to an experimental group receiving intensive peer mentoring (one hour each week during rehabilitation and for 90 days post discharge) or a control group that did not. Now that research is complete, all patients participate in operationalized peer mentorship during care provision. Clinicians became advocates of including peers after witnessing significant increases in patient engagement when peers were involved. A member of the peer support team will describe how the research study elevated peer involvement in multiple aspects of care provision, helped gain organizational support for such programs, and fostered expansion of social media that can serve as a first line provision of peer support when local resources are limited. Audience members will be encouraged to

ask questions and participate in discussions throughout the course. We will end the workshop with a brainstorming session about how to use these models to develop take-home goals that seek to involve peer mentorship in rehabilitation care provision in home environments.

Results: Persons randomized to the experimental group had significantly fewer rehospitalizations ($P=0.0001$) and higher growth rates of self-efficacy scores ($P<0.0001$) in the 180 days after injury.

Conclusion: Research data that validates the importance of peer mentorship can be used to gain organizational support, integrate peer programs into rehabilitation culture, and improve outcomes.

Support: Patient-Centered Outcomes Research Institute; Robert W Woodruff Foundation

26 Phoenix: translating an SCI self-management intervention for telehealth

Susan D. Newman¹, Sherwood L. Toatley^{1,2}, Marka D. Rodgers^{1,3}, Diane Epperly²

¹Medical University of South Carolina, College of Nursing, Charleston, SC, USA; ²South Carolina Spinal Cord Injury Association, Columbia, SC, USA; ³Center for Spinal Cord Injury, Charleston, SC, USA

Objective: Our team's previous research explored the use of trained Peer Navigators to promote self-management after spinal cord injury (SCI) through in-person health education and peer support. Building on this previous work, our Peer-supported Health Optimization, Education, and Information eXchange (PHOENIX) intervention aims extend the reach of the Peer Navigators through telehealth. This abstract describes a 1-year, 2-phase pilot study that supported the preliminary development and evaluation of new multimedia and technology-enhanced components to translate Peer Navigation for telehealth delivery.

Design: Using a community-based participatory research approach, our team conducted pilot work to support the development of our PHOENIX self-management intervention in partnership with the South Carolina Spinal Cord Injury Association (SCSCIA). The primary aim of Phase 1 was to collaborate with our community partners in the development of appealing and appropriate multimedia educational content related to SCI self-management and prevention of secondary conditions. The primary aim of Phase 2 was to evaluate the basic features, operation, and user preferences for the educational content, tablet computers, and video conferencing.

Methods: During Phase 1, we produced two videos on prevention of secondary conditions, pressure ulcers and urinary tract infections, and built the PHOENIX curriculum online using iTunes U. Creating the videos included participation of individuals with SCI in script writing, acting, and directing roles. During Phase 2, we recruited 10 individuals with SCI to evaluate the educational videos, and the use of tablet computers to access PHOENIX, and video chat with the Peer Navigators. The evaluation consisted of a combination of observational, interview, and self-report survey data analyses.

Results: Results of our usability surveys for iTunes U and the tele-video platform indicated high user satisfaction. Qualitative feedback on the educational videos included comments: "The videos got you motivated and held your attention;" "The videos were funny and I liked the sitcom format [of the UTI video]."

Conclusion: Our evaluation processes provided direct user feedback on the usability and acceptability of the online and telehealth implementation of PHOENIX, which is essential information to guide the refinement and testing of PHOENIX in future larger studies.

Support: This study was funded by Grant #2015P-02 from the South Carolina SCI Research Fund.

27 Prevalence, characteristics and survival of tracheostomy ventilated versus non-invasively ventilated veterans with ALS, a regional experience

Marinella D Galea^{1,2,3}, April Jones¹, Carmen Rivas¹, Marcia Ferguson¹, Swapna Johnson-Kunjukutt^{1,3}

¹The James J Peters VAMC, Bronx, NY, USA; ²Ichan School of Medicine at Mount Sinai, New York, NY, USA;

³Columbia University School of Medicine, New York, NY, USA

Objective: Rates of amyotrophic lateral sclerosis (ALS) are higher in US military veterans. In 2009 the Department of Veterans Affairs declared ALS a service connected condition, granting disability compensation and care free of charge to veterans with ALS. Provision of services for persons with ALS varies within and between countries, influenced by treating physician attitudes, insurance coverage, and cultural standards. To our knowledge no studies evaluated how receiving VA benefits influences ALS veterans' outcomes. Specifically since respiratory failure is the main cause of death in patients with ALS, we evaluated the characteristic of veterans who opt to receive tracheostomy ventilation (TV) versus those who choose noninvasive ventilation (NIV).

Design: Retrospective chart review of veterans with a diagnosis of ALS enrolled at the ALS clinic at the Bronx VAMC from January 2014 to January 2017.

Methods: Of the 85 veterans enrolled at the ALS clinic, all were seen at least one time and all had documentation of discussion of goal of care. Ten veterans underwent TV, 47 choose NIV. Of the TV group, 7 had lower motor neuron onset and 3 bulbar, versus 12 and 35 respectively for the NIV group. All veterans were males. Mean age was 67.7 years for the TV group and 71.6 for the NIV group. All the patients in the TV group were Caucasian versus 36 Caucasian, 6 African American, 1 Asian and 4 unknown in the NIV group. Of all patients 43 were Vietnam veterans. Average time from diagnosis to TV was 53.2 months and 27.6 to NIV. 5 veterans on the TV group underwent emergency tracheostomy, and 5 elective. Average months on TV was 19.9 and 4.6 months on NIV.

Results: Of the total number of patients requiring respiratory support, the majority choose NIV (83%) versus TV (17%). The TV group was younger than the NIV group. The NIV group was more diverse. As described, most patients were Vietnam veterans. 70% of the TV group had peripheral onset, while 75% of the NIV group had bulbar onset. The TV group waited longer from time to diagnosis and survived longer than the NIV group.

Conclusion: Our study shows that despite availability of free of charge services, including long term care ventilator units, more veterans choose NIV versus TV. As shown in previous studies, TV prolongs survival considerably compared with NIV. Discussing goal of care during ALS clinic visits appears to contribute to the choice of NIV versus TV.

28 Prevalence of deep vein thrombosis on admission screening of complete spinal cord injury patients in acute rehabilitation

Beverly Hon^{1,2}, Steven Kirshblum^{1,2}

¹Rutgers New Jersey Medical School, Department of Physical Medicine and Rehabilitation, Newark, NJ, USA;

²Kessler Institute for Rehabilitation, West Orange, NJ, USA

Objective: The most recent spinal cord injury (SCI) consortium guidelines (2016) recommends against routine duplex Ultrasound (US) surveillance for deep venous thrombosis (DVT) at rehabilitation admission. This current analysis was performed to determine if there is a higher rate of DVT found on routine duplex US screen in patients with more severe injuries (based upon ASIA Impairment Scale (AIS) classification), and if so, the degree of motor sparing may serve as a risk factor for US surveillance.

Design: Retrospective chart review.

Participants/methods: Patients admitted to an acute rehabilitation hospital between January 1, 2011 to December 31, 2016, within 2 weeks of sustaining a new traumatic SCI. Inclusion criteria included documentation of an initial AIS level (A, B, C, or D) and duplex screening within 72 hours of rehabilitation admission.

Results: 169 patients met inclusion criteria including 24.3% with AIS A, 13.0% with AIS B, 22.5% with AIS C, and 40.2% with AIS D. Overall, 18.9% were positive for DVT; with 26.8% in persons with AIS A, 18.2%, 28.9% and 8.8% in AIS B, AIS C, and AIS D respectively. While there was a difference in positive duplex US screening for DVT by AIS level (26.8% in neurologically complete and 16.4% in neurologically incomplete injuries), this difference was not statistically significant. There is however a statistically significant difference in positive duplex screenings between AIS A, B, C (25.7%) versus AIS D patients (8.8%). 75.14% of patients screened were admitted on some form of chemoprophylaxis. Interestingly, the presence of positive duplex finding did not differ between patients on DVT chemoprophylaxis (18.9%) and those off it (19.0%).

Conclusion: Spinal cord injury patients classified as AIS A, B, or C at rehabilitation admission had a significantly higher number of positive duplex screens compared to AIS D patients, with the degree of chemoprophylaxis not playing a significant role in this study. As such, further study is needed to determine specific risk factors for appropriate surveillance.

29 Regenerative treatments for chronic shoulder pain in spinal cord injury

Trevor Dyson-Hudson^{1,2}, Reina Nakamura², Alon Terry³, Steven Kirshblum^{1,2,4}, Gerard A. Malanga^{2,4,5}

¹Kessler Foundation, West Orange, NJ, USA; ²Department of Physical Medicine and Rehabilitation, Rutgers New Jersey Medical School, Newark, NJ, USA; ³Summit Medical Group, Summit, NJ, USA; ⁴Kessler Institute for Rehabilitation, West Orange, NJ, USA; ⁵New Jersey Regenerative Institute, Cedar Grove, NJ, USA

Objective: Rotator cuff tendinopathy (disease) is a common cause of shoulder pain in persons with chronic spinal cord injury (SCI). It usually resolves with non-operative treatments; however, when conservative therapy fails, surgery may be the only option. Studies suggest that regenerative treatments such as autologous growth factor injection using platelet rich plasma (PRP) may stimulate recovery in non-healing musculotendinous injuries. The efficacy of PRP in those with SCI and chronic rotator cuff disease, however, is unclear. This was a pilot study (ClinicalTrials.gov identifier: NCT01355549) to determine the efficacy and safety of PRP therapy for chronic shoulder pain due to rotator cuff disease in persons with SCI.

Design: Prospective case series.

Participants/methods: Six men with chronic SCI (duration of injury: 26.7yr±11.1yr) and chronic rotator cuff disease unresponsive to nonsurgical treatment for longer than 6 months had 60 mL of whole blood prepared according to PRP protocols (Harvest[®] SmartPreP[®], Somerset, NJ). A total of 3-4 mL of PRP was injected into the tendon under ultrasound-guidance using a peppering technique. Subjects began a standardized stretching protocol after 24hrs and a formal strengthening program after 4wks. Participants were followed for adverse events and changes in shoulder pain intensity on an 11-point numerical rating scale (NRS; 0-10) and the Wheelchair User's Shoulder Pain Index (WUSPI; range 0-150). Subjects were examined at 4 weeks and 24 weeks. Mixed effect models with random intercept were applied to determine the change in NRS and WUSPI scores from baseline.

Results: There was a significant decrease in WUSPI scores at 4 weeks (58.8 points; <0.0001) that were maintained at 24 weeks (67.5 points; P=0.0001). There was also a significant decrease in NRS at 4 weeks (P=0.0021) that was maintained at 24 weeks (P=0.0035). No significant adverse events were reported.

Conclusion: Results suggest that a single PRP injection can improve pain and function scores in persons with SCI with recalcitrant rotator cuff disease, thus possibly avoiding surgery. Lack of blinding and a suitable control group may have influenced results. A larger, more definitive randomized controlled trial is warranted.

Support: Kessler Foundation

30 Resilience among adults living with SCI and their caregivers

Susan Ryerson Espino^{1,2}, Kerry O'Rourke¹, Erin H. Kelly^{2,3}, Azadeh Ghaffari⁴, Gerald Harris^{1,2}, Michael Richardson⁴, David Chen⁵, Ray Lee⁶, Lawrence C. Vogel^{1,2,7}

¹Marquette University, Milwaukee, WI, USA; ²Shriners Hospitals for Children, Chicago, IL, USA; ³American Academy of Pediatrics, Elk Grove Village, IL, USA; ⁴Hines Veteran Administration, Hines, IL, USA; ⁵Rehabilitation Institute of Chicago, Chicago, IL, USA; ⁶Schwab Rehabilitation Hospital, Chicago, IL, USA; ⁷Rush University, Chicago, IL, USA

Objective: Studies addressing caregivers commonly emphasize negative outcomes. This study explored promising facilitators of well-being for caregivers of civilians and veterans with spinal cord injury (SCI).

Design: Longitudinal mixed methods study of 32 civilian and veteran dyads from three USA rehabilitation hospitals and one Veterans Administration hospital.

Participants/methods: Members of dyads participated in qualitative interviews guided by a semi-structured protocol. Quantitative data included standardized surveys on caregiver burden, problem solving, and satisfaction with leisure time, along with surveys on mental health and well-being for both members of the dyad. Follow-up qualitative interviews were conducted approximately 15 months later to clarify and deepen understandings of well-being. Participants with SCI were injured on average at age 22 years (17-37) and interviewed on average at 37 years (26-53); 71% had tetraplegia; 52% were injured in transportation incidents; 68% were male; and 23% were veterans. Caregivers were an average of 50 years old (22-77); mostly female (81%); ethnic minorities (52%); high school educated or higher (87%); and were a parent (48%), spouse/significant other (42%), sibling (7%), or other relative (3%) to the adult with SCI.

Results: Qualitative narratives spoke to the important facilitators of dyad well-being including family cooperation, positive interpersonal relations, self-care, and collaboration with paid non-family caregivers and personal care assistants. In quantitative data, caregivers demonstrating fewer challenges with problem solving and greater leisure time satisfaction experienced lower burden ($P < 0.01$); together these accounted for 65% of the variance in caregiver burden. Importantly, caregiver burden and challenges with problem solving were associated with mental distress among civilians (not veterans) with SCI.

Conclusion: Findings suggest the importance of caregiver self-care, leisure time satisfaction, skills development (including problem solving and interpersonal communication), and collaboration with other family members and personal care assistants. For instance, problem solving training aiming to reduce the tendency to view problems as insurmountable and reduce reliance on strategies such as avoidance and applying hurried/incomplete solutions has promise to contribute to the well-being of caregivers and adults living with SCI.

Support: This study is funded by the U.S. Department of Defense (Grant #SC130279).

31 Resource facilitation: early inpatient/assertive outpatient vocational rehabilitation services in SCI

John O'Neill^{1,2,3}, Trevor A. Dyson Hudson^{1,2,3}, Mary Lea West³,
Steven C. Kirshblum^{1,2,3}

¹Kessler Foundation, West Orange, NJ, USA; ²Department of Physical Medicine and Rehabilitation, Rutgers New Jersey Medical School, Newark, NJ, USA; ³Kessler Institute for Rehabilitation, West Orange, NJ, USA

Objective: Test feasibility of delivering vocational resource facilitation services to newly injured individuals with spinal cord injury (SCI) during inpatient stay that continues after discharge to the community—leading to competitive integrated employment.

Design: Prospective study without controls

Participants/methods: Newly injury persons with non-progressive SCI between the ages of 18-64 admitted for inpatient rehabilitation at Kessler Institute who resided in the Northern/Central New Jersey area after discharge and were interested in pursuing competitive employment. The intervention consists of a vocational resource facilitator (VRF) being the single point of contact providing medical/vocational case coordination to inpatients and outpatients to ensure the continuity of vocational rehabilitation services upon discharge and long-term follow-up in the community.

Results: Preliminary results from the first seven months of the program identified 54 inpatients that were eligible for participation (75% men; mean age = 37 ± 13 years [range 21-61 years]; 37% tetraplegia, 30% paraplegia, 33% non-traumatic SCI; average length of inpatient stay = 45 ± 26 days. At time of discharge, 26 (48%) of these individuals remained interested in pursuing employment (85% men; mean age = 32 ± 10 years [range 21-61 years]; 42% tetraplegia, 46% paraplegia, 12% non-traumatic SCI; average length of stay = 56 ± 28 days. Twenty-one (81%) of these outpatient individuals were referred for state vocational rehabilitation services, with 17 actively engaged in the vocational rehabilitation process. Six of the 26 outpatient individuals

returned to work: four to same employer-same job and two to same employer-different/modified job. None who returned to work received state sponsored vocational rehabilitation services; although two were referred for services, but were denied due to income restrictions. Two who returned to work were referred by the VRF to community based assistive technology experts and received devices required for their return to work.

Conclusion: Preliminary finding indicate considerable interest in employment among newly injured persons with SCI. Almost half of all eligible inpatients remained actively engaged in pursuing employment after discharge with some returning to work immediately and others actively working with the state vocational rehabilitation agency to secure competitive employment.

Support: This project is funded by the Craig H. Nielsen Foundation.

32 Responses to non-invasive autonomic-cardiovascular testing in persons with spinal cord injury compared to intact controls

Jill M. Wecht^{1,2}, Joseph P. Weir^{1,4}, Matthew T. Maher¹, Nhuquynh D. Nguyen¹, Alexander T. Lombard^{1,3}, Steven C. Kirshblum^{3,5}, William A. Bauman^{1,2}

¹James J Peters VA Medical Center, Bronx, NY, USA; ²Icahn School of Medicine at Mount Sinai, New York, NY, USA; ³Kessler Institute for Rehabilitation, West Orange, NJ, USA; ⁴University of Kansas, Lawrence, KS, USA; ⁵Rutgers New Jersey Medical School, Newark, NJ, USA

Objective: Impaired autonomic regulation of the cardiovascular system in individuals with spinal cord injury (SCI) is generally accepted, which may be dependent on the level of injury. However, the extent of alteration in this regulatory process cannot be accurately measured due to the lack of validated and reliable clinical assessment tools. A short, relatively easy to administer, non-invasive battery of tests has been developed for use to test autonomic cardiovascular integrity in individuals with autonomic failure, but this battery has not been tested for use in the SCI population. It was hypothesized that individuals with higher levels of SCI (above T6) would have significantly altered responses to these tests compared to the controls.

Design: Prospective cross-sectional study design.

Participants/methods: This battery of tests requires monitoring of heart rate (HR) and blood pressure (BP) for 5 minutes under the following conditions: supine rest (BL), postural shift from supine to seated (POS), deep breathing (DB) and the Valsalva maneuver (Vm). The cardiovascular parameters reported include change in the inter-beat-interval (IBI) of HR and systolic BP (SBP) from rest to during the provocations. Testing has been completed in 98 individuals with SCI and 34 healthy controls. Subjects with SCI were chronically injured (13 ± 11 years), 39 with tetraplegia (Tetra: C4-C8), 14 with high paraplegia (HP: T1-T5) and 45 with low paraplegia (LP: T6-L3).

Results: Age did not differ between the SCI and control groups (44 ± 13 vs. 43 ± 12 years). Although the IBI response to the DB test was diminished in the Tetra (1126 ± 120 msec) compared to the control group (1182 ± 108 msec), this difference was not statistically significant. The magnitude of the fall in SBP during the POS test was significantly greater in the Tetra (-25 ± 2 mmHg) compared to the controls (-10 ± 4 mmHg; $P < 0.0001$), HP (-10 ± 5 mmHg; $P < 0.001$) and LP (-12 ± 9 mmHg; $p < 0.0001$) groups. Finally, compared to the controls (413 ± 341 msec/mmHg), the ratio of HR/SBP change during the Vm was significantly reduced in the Tetra (214 ± 141 msec/mmHg; $P < 0.01$), HP (209 ± 181 msec/mmHg; $P < 0.01$) and LP (200 ± 116 msec/mmHg; $P < 0.01$) groups.

Conclusion: In general the tests are easy to perform, and the data suggest that responses to this battery are able to discern differences in autonomic-cardiovascular regulation as it pertains to level of SCI.

Support: VA RR&D Service Grants # B9212-C and B2002-C.

33 Self-efficacy and physical function in individuals with SCI/D

Jennifer N. Hill¹, Bella Etingen¹, Scott Miskevics¹, Sherri L. LaVela^{1,2}

¹Center of Innovation for Complex Chronic Healthcare (CINCCCH), Department of Veterans Affairs, Edward Hines Jr. VA Hospital, Hines, IL, USA; ²Department of Physical Medicine and Rehabilitation, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA

Objective: Our objective was to examine self-efficacy in Veterans with spinal cord injuries/disorders (SCI/D) reporting high vs low perceptions of elements of their physical function.

Design: Cross-sectional mailed survey.

Participants/methods: A nation-wide sample of Veterans with SCI/D provided data on: demographics, injury characteristics, basic mobility, fine motor function, and self-efficacy. Bivariate comparisons were conducted to compare reported self-efficacy between participants with “high” vs “low” basic mobility and fine motor function. Multivariate logistic regression identified factors independently associated with high physical function when controlling for covariates.

Results: Response rate (896/1452 = 61.7%). Our sample (n=896) was primarily male (93.4%), white (72.2%), and married (57.7%). Respondents reported an average age of 62.9 years and had been living with their SCI/D for 22.9 years on average. Nearly two-thirds (62.9%) reported having a paraplegic injury. Veterans with high (vs low) basic mobility reported higher self-efficacy (46.2 vs 41.7, $P < 0.0001$). Similarly, Veterans with high (vs. low) fine motor function reported higher self-efficacy (45.9 vs 41.8, $P < .0001$). Multivariate analysis showed that age (OR=0.98, CI95: 0.96-1.00, $p=0.03$), tetraplegia (OR=0.20, CI95: 0.13-0.32, $P < 0.0001$), diabetes (OR=0.53, CI95: 0.31-0.91, $P=0.02$), depression (OR=0.62, CI95: 0.39-0.98, $P=0.04$), and pressure ulcers (OR=0.42, CI95: 0.25-0.72, $P=0.001$) were independently associated with lower odds of high physical function. When controlling for covariates, persons with high self-efficacy were nearly 2-times more likely to have high physical function (OR=1.98, CI95: 1.22-3.22, $P=0.01$).

Conclusion: Lower basic mobility and fine motor function among individuals with SCI/D were associated with lower self-efficacy, even when controlling for other covariates. In the context of chronic incurable disease/disability, individuals need to be empowered and compelled to take steps to support their own optimal health and well-being. Interventions focused on promoting physical function (e.g. supporting regular physical activity appropriate for the patient) may both improve elements of functionality and bolster self-efficacy.

Support: This work was supported by the Department of Veterans Affairs, Health Services Research and Development, Rapid Response Project (RRP) 13-248.

34 Translating research into practice: patient education models to family education

Julie Gassaway, Tamara Young, Kimberly Queen

Shepherd Center, Atlanta, GA, USA

Objectives: 1. Summarize research findings validating importance of including peers in spinal cord injury (SCI) rehabilitation patient education (significantly increased classroom engagement and lowered rehospitalization rates). 2. Demonstrate how we used similar design models to enhance family training programs and describe observed differences in engagement. 3. Initiate discussion with audience participants on how to use these models to develop goals that impact education practices in home environments.

Design: Multiple baseline implementation and interrupted time series analyses of patient education research translated into family education enhancements.

Participants/methods: All patients receiving inpatient rehabilitation for SCI who attended group patient education classes were included in the formal research evaluation of patient education. We enhanced interactive content of classes, put peers at the center of education processes, and saw engagement increase. Nurse educators, who were concerned about low levels of engagement in family training, applied similar design approaches to family training classes. They replaced conventional lecture designs with interactive content, including video vignettes of people with SCI and their families that help families identify immediate needs and focus on problem solving strategies. Content mimics what is presented in patient education classes, which increases relatability for families to talk with patients about what is learned in both classes. All participants in family education classes now receive redesigned family education. We will

conclude the workshop with audience discussions of opportunities and challenges in replicating these approaches in home environments.

Results: Patient engagement in the peer-led classes was significantly greater ($P < 0.0001$) compared to traditional style classes. Interrupted time series analyses of rehospitalization show a significant decrease for readmission after intervention ($P < 0.0001$). After using the revised interactive approach for family education, nurse educators witnessed similar immediate and dramatic increases in participant engagement as they had seen in the patient education classes.

Conclusion: Patient-centered approaches to education that resulted in significant improvements in patient engagement during SCI rehabilitation education classes and fewer rehospitalizations, can be used in other aspects of rehabilitation education, including family training, to increase engagement.

Support: Patient-Centered Outcomes Research Institute

35 Translating upper extremity research evidence into a wellness-based model

Catherine Murray, Julie Jennings, Zahra Kadivar, Tiffany Bollmeyer

TIRR Memorial Hermann, Houston, TX, USA

Background: According to the national spinal cord Injury statistical center, annual incidence of spinal cord injury (SCI) in the US, is approximately 12 000 new cases each year. Incomplete tetraplegia is the most frequent diagnosis since the year 2000. Recovery of upper extremity (UE) function is one of the most important factors that contributes to quality of life in persons with tetraplegia. Despite the impact of UE function on level of independence after SCI and the evidence that plasticity-based approaches with repetitive training improve UE function, rehabilitation is limited by number of visits governed by third-party payors. To overcome such limitations, “SCI ARM (Active Recovery of Movement)”, was designed in an outpatient wellness facility at TIRR Memorial Hermann. The goal of this presentation is to provide a retrospective analysis on the effectiveness of this community based wellness model to translate the evidence into practice.

Methods: SCI ARM included blocked practice, with somatosensory stimulation, of functional activities: isolated finger movement, pinch, grasp, and whole arm movements. The amount of practice for each activity was based on results of the Graded Redefined Assessment of Strength Sensibility and Prehension (GRASSP) assessment which was obtained pre/post intervention. An occupational therapist, fitness specialist, and rehabilitation technician implemented the program.

Result: To date, three persons with tetraplegia (C5-C7 levels of injury), 3 months, 1.5 years and 7 years since injury completed this program. Average age of individuals was 20.6 years. All participants made improvements in these domains: strength, sensation and hand function. Hand function (29%) and strength (12%) were the domains with the most and least amount of improvement respectively. The participant with the shortest time since injury had the most significant improvement as indicated by 45% overall gains in GRASSP. Phase II of this program is presently underway, phase III will follow. At time of presentation, results of all participants and outcomes will be reviewed.

Conclusion: These results indicate that implementation of an evidence based community wellness program may facilitate improvement of upper extremity function and highlights evidence for continued neuroplasticity years after injury.

Limitations: Further investigation of a larger population including different age groups and controlling for potential external factors is recommended.

36 Using patient photos and physical function in individuals with SCI/D

Jennifer N. Hill¹, Salva Balbale^{1,2}, Sherri L. LaVela^{1,3}

¹Center of Innovation for Complex Chronic Healthcare (CINCCCH), Department of Veterans Affairs, Edward Hines Jr. VA Hospital, Hines, IL, USA; ²Center for Healthcare Studies, Institute for Public Health and Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL, USA; ³Department of Physical Medicine and Rehabilitation; Feinberg School of Medicine, Northwestern University, Chicago, IL, USA

Objective: To explore how patients with spinal cord injuries and disorders (SCI/D) define function including facilitators, barriers, and adaptations made to support their functioning using patient photos and interviews.

Design: Cross-sectional, photovoice with semi-structured interviews.

Participants/methods: Patients with SCI/D were provided with cameras and prompts including: take photographs of things that (1) help you function (2) are barriers to your function and (3) represent adaptations you use to support functioning. Interviews followed 3-4 weeks later; they were audio-recorded, transcribed, and analyzed using grounded-thematic coding to identify emergent themes. The International Classification of Functioning, Disability, and Health (ICF) was used to conduct an additional level of synthesis to explore how emergent themes fell within ICF (presented in brackets below).

Results: Participants (n=9) were male (89%), Caucasian (67%), had paraplegia (75%), averaged 64 years of age, with an average length of injury of 22 years. The themes of independence aspects of daily living [activities and participation] emerged as essential components of the overall definition of function. Patients reported many [environmental] factors that served as facilitators including: helpful tools, weightlifting, family, their therapists, paid-caregivers and VA health care team. Participants also reported a number of [environmental] barriers to function including challenges with wheelchairs, areas in the community (e.g. breakdown of sidewalks, accessibility issues), and within the VA hospital (e.g. steep curb-cuts, difficult to access sinks in patient rooms). Finally, adaptation to [environmental] barriers were used by patients including modifications to their homes [e.g. ramps] as well as adaptations to support [activities and participation] such as creative use of rubber bands to help hold soda cans or open doors.

Conclusion: The themes that emerged within the photos and interviews with patients were consistent with the categories of the ICF. However, providing a patient the opportunity to define their own function may be useful in framing a conversation for developing personalized, patient-drive care plans that can be used in goal-setting related to function.

Support: This work was supported by the Department of Veterans Affairs (VA), Office of Research and Development (ORD) Health Services Research and Development (HSR&D) Rapid Response Project (RRP) 13-248.

37 Web-based intervention to promote exercise among people with spinal cord injury

Maria Cole¹, Katherine Froehlich-Grobe², Simon Driver²

¹Baylor Scott & White Research Institute, Dallas, TX, USA; ²Baylor Institute for Rehabilitation, Dallas, TX, USA

Objective: Adopting a physically active lifestyle is a promising approach to help improve the health and function of individuals living with spinal cord injury (SCI), yet the evidence base is limited regarding effective strategies. The purpose of this pilot study is to test the feasibility of using an online approach to promote physical activity among people with SCI.

Design: Workout on Wheels internet intervention (WOWii) is a theory-based approach to promoting exercise adoption among people with SCI designed to be delivered through 16 modules and weekly virtual meetings. Pilot testing of WOWii to assess feasibility was conducted over a 4-week trial with 10 participants SCI with SCI. Participants received a starter package of exercise equipment to facilitate immediate access to home-based exercise options appropriate for wheelchair users and also provided staff support and facilitated peer support.

Participants/methods: Feasibility was defined as participant website engagement, measured as adherence with key intervention components (e.g. completing weekly online activities and attending the virtual weekly meetings).

Results: Average completion of the four online forms was 85% and attendance averaged 82.5% over the 4 virtual meetings.

Conclusion: Results from a pilot of the feasibility of using the website among a sample of 10 people with SCI indicated high engagement as measured by completing the weekly online activities and attending weekly virtual meetings. Further testing of the site in a larger randomized controlled trial will reveal whether these positive results can be sustained over longer period and result in greater weekly exercise.

Support: I am receiving financial support from Baylor Scott & White Research Institute.